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Research report

A mixed methods study of food safety knowledge, practices and beliefs in Hispanic families with young children [☆]

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ABSTRACT

Children are at a higher risk for foodborne illness. The objective of this study was to explore food safety knowledge, beliefs and practices among Hispanic families with young children (≤ 10 years of age) living within a Midwestern state. A convergent mixed methods design collected qualitative and quantitative data in parallel. Food safety knowledge surveys were administered ($n = 90$) prior to exploration of beliefs and practices among six focus groups ($n = 52$) conducted by bilingual interpreters in community sites in five cities/towns. Descriptive statistics determined knowledge scores and thematic coding unveiled beliefs and practices. Data sets were merged to assess concordance. Participants were female (96%), 35.7 (± 7.6) years of age, from Mexico (69%), with the majority having a low education level. Food safety knowledge was low ($56\% \pm 11$). Focus group themes were: Ethnic dishes popular, Relating food to illness, Fresh food in home country, Food safety practices, and Face to face learning. Mixed method analysis revealed high self confidence in preparing food safely with low safe food handling knowledge and the presence of some cultural beliefs. On-site Spanish classes and materials were preferred venues for food safety education. Bilingual food safety messaging targeting common ethnic foods and cultural beliefs and practices is indicated to lower the risk of foodborne illness in Hispanic families with young children.

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Introduction

According to the Centers for Disease Control and Prevention, an estimated one in six Americans (or 48 million people) become sick, 128,000 are hospitalized, and 3000 die of foodborne diseases every year (Scallan et al., 2011). The objectives of Healthy People 2020 include reducing infections in the general population caused by key pathogens commonly transmitted through food (*Campylobacter*, Shiga toxin producing *E. coli* (STEC) O157, *Listeria monocytogenes*, *Salmonella*, *Vibrio*, *Yersinia*) and the incidence of post diarrheal hemolytic-uremic syndrome (HUS) in children under five years of age (U.S.

Department of Health and Human Services). Children are at higher risk than other populations related to lower body weight, less acidic stomachs, under developed immune systems, and lack of control in food preparation (Pew Health Group, 2009).

Hispanics/Latinos are the fastest growing ethnic minority group in the United States, increasing by 43% during 2000–2010 and are estimated to comprise over 30% of the United States population by the year 2050 (U.S. Census Bureau, 2011). The incidence of *Listeria* outbreaks, a leading cause of death from foodborne illness in the United States, is higher among Hispanics than any other group (Voetsch, Angulo, & Jones, 2007). United States foodborne illness outbreaks involving *Listeria* and raw Mexican-style cheese have affected Hispanic groups. In 1985, a large *Listeria* outbreak among mostly Hispanics (96%) in southern California resulted in 48 deaths (20 fetuses, 10 neonates, and 18 adults) (Linnan et al., 1988). Another *Listeria* outbreak (2000–2001) that affected only Hispanics in Winston-Salem, North Carolina resulted in five stillbirths, three premature deliveries, and three infected newborns from consuming fresh cheese made at a local dairy (MacDonald et al., 2005).

Limited studies of food safety practices in Hispanics have been published. Household observations of food preparation in a Puerto Rican community found 90% of the participants did not wash their hands with

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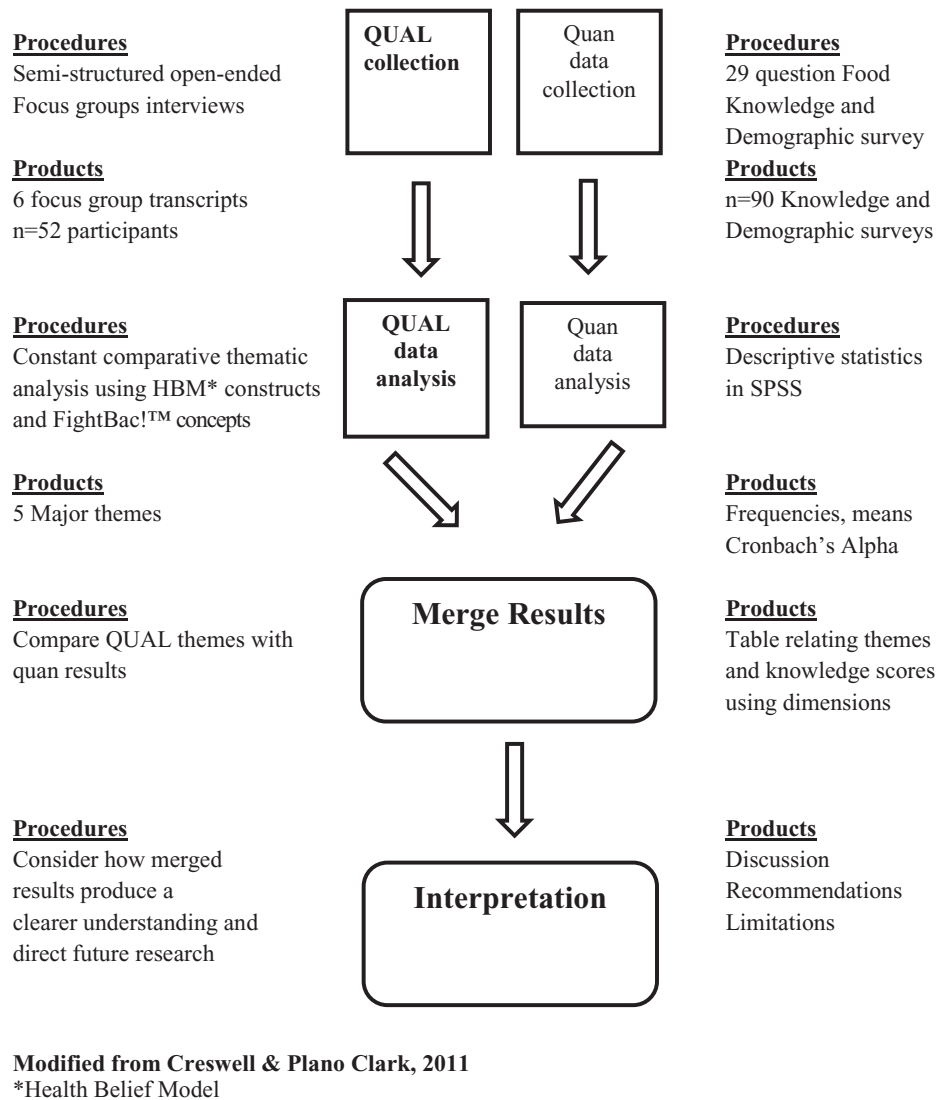


Fig. 1. Convergent parallel mixed methods design of food safety study among Hispanic Main Food Preparers for young children in Nebraska.

soap, 89% used the same cutting board for meat and vegetables, and no use of a thermometer to check the temperature of cooked meat. Five percent gave a proper definition of cross-contamination and unsafe thawing procedures were described (Bermudez-Millan, Perez-Escamilla, Damio, Gonzalez, & Segura-Perez, 2003). In a comparison of self-reported and observed behavior regarding food handling procedures among Latinas, over-reporting of hand washing and cutting board cleaning occurred (Dharod, Perez-Escamilla, Bermudez-Millan, Segura-Perez, & Damio, 2004). The researchers found significant positive correlations between proper thawing methods and prior food safety education, using a cutting board and higher income, and washing tomatoes and having a positive attitude about food safety. Another study reported large knowledge gaps in food safety in this population and acculturation had no effect on knowledge (Diaz-Knauf et al., 1993).

It is unknown if cultural beliefs and practices have an influence on food safety within Hispanic families. Herbalists (yerberos) and lay healers (curanderos) (Batty & Kurko, 2005) are used in this population. A known Hispanic belief is the hot/cold theory of disease. Good health is dependent upon maintaining balance between hot and cold. An ailment that is "hot" requires treatment that is "cold". Organs of the body, diseases, herbs and foods, and liquids may be "hot" or "cold". Herbs and foods can be used in treatments to restore balance.

Reducing the incidence of foodborne illness among Hispanic families may increase quality of life, decrease morbidity, mortality, and resources needed to treat the illness. The purpose of this mixed methods study was to examine food safety among main food preparers in Hispanic families with young children in a Midwestern State. Qualitative inquiry explored the presence of food safety practices, attitudes, and cultural beliefs among primary food handlers. A quantitative survey measured food safety knowledge. The extent that food safety knowledge supported or diverged from food safety practices, attitudes and cultural beliefs reported by Hispanic families with young children was observed.

Methods

Study design

The methodology of mixed methods research was selected for its ability to provide completeness, explanation, unexpected results, illustration, (Bryman, 2006) and to obtain complementary data on the same topic (Morse, 1991). A convergent mixed methods design

(Fig. 1) was used whereby qualitative and quantitative data are collected in parallel, analyzed separately and then merged (Creswell & Plano Clark, 2011). Qualitative inquiry provided insight to beliefs and practices that were not discovered by quantitative inquiry. Two data types were linked together through analysis to enrich the data, give deeper understanding, and yield a more complete picture. The qualitative inquiry was given priority over the quantitative research due to the exploratory nature of this topic. All components of the study received University Review Board approval (IRB# 2011112136FX, 2012011224EX).

Instrument development

A semi-structured, open-ended focus group script used in a previous study among main food preparers was adopted (Meysenburg, Albrecht, Litchfield, & Ritter-Gooder, 2014). The script explored the context of food handling through the lens of the Health Belief Model (Rosenstock, Strecher & Becker, 1998). The model's constructs, perceived susceptibility and severity, perceived costs and benefits, self-efficacy, and cues to action, are indicative of health behaviors.

A food safety knowledge survey instrument was adapted for the study (Byrd-Bredbenner, Schaffner, Mauer, & Abbot, 2010; Byrd-Bredbenner et al., 2007). Multiple choice and true/false survey questions were categorized into the Partnership for Food Safety Education critical consumer messages; FightBAC!™ concepts: Clean, Separate, Cook, and Chill (U.S. Department of Agriculture website for Partnership for Food Safety Education (PFSE), 2010). Two additional categories, groups at increased risk, and foods that increase risk, were added to unveil any cultural understandings impacting food safety within this ethnic group. Questions within all concepts and groups were randomly ordered within the questionnaire. The survey was shortened and clarified for cultural appropriateness by extension food educators who had experience working with this population. Content validity was provided by food safety experts to rate clarity, repetitiveness, constructs relevance and content domain (McGartland, Berg-Weger, Tebb, Lee, & Rauch, 2003). Buros Center for Testing (<http://buros.org/about#mission>), an independent organization designed to improve the science and practice of testing and assessment, provided a holistic evaluation of the survey, followed by focused evaluation of key elements. Survey directions, language and grammar, item format, item stems, response options and length were revised based upon the evaluation. The survey was translated into Spanish by a local Latino bilingual United States extension educator, born in Mexico, who worked in food safety with the Hispanic population studied.

The survey was pilot tested among primary food handlers in Hispanic families with children 10 years old and younger ($n = 38$) who were recruited through word of mouth from local Hispanic community centers within two Midwestern cities. To address the sensitive nature and funding mandate requiring the use of social security numbers, informed consent assured that personal information would not be verified and would be immediately detached from the survey upon issuance of a \$5 gift card for participation. Based on pilot study results (Cronbach's alpha of $r = 0.55$), the survey was reduced in length from 41 to 29 questions. No changes were made in the remaining survey questions.

Participant recruitment

Recruitment occurred among respected existing members of the Hispanic community to gain trust. Snowballing technique provided a convenient sample of participants recruited through the use of bilingual Hispanic contacts and local extension educators among several Hispanic community centers, churches, and by community members in five cities. Inclusion criteria were Hispanic ethnicity

and primary food handler (parent, relative, or other caregiver) for children ≤ 10 years of age. Informed consent procedures used for the earlier pilot study were followed and a \$25 retail gift card was given to participants who completed the study.

Quantitative data collection and analysis

The food safety knowledge survey was administered after informed consent was given and prior to each focus group session. The 20–30 minute written survey was available in English and Spanish. Test scores were calculated by comparing the number of correct responses selected to the total number of correct responses possible. Knowledge scores within each construct and group were also calculated. Focus group quantitative data were pooled with pilot study data and analyzed for means, frequencies and overall knowledge test scores using SPSS (SPSS version 21, SPSS, Inc., Chicago, IL 2012). Cronbach's alpha was used to measure internal consistency or reliability.

Qualitative data collection and analysis

The Krueger methodology for conducting focus group discussions was followed using the semi-structured, open-ended script to allow the researcher to guide the sessions and obtain the participants views (Krueger, 1994). Six audio taped focus group discussions were conducted by the same researcher, who had some vernacular use of the Spanish language, and a bilingual (English and Spanish) interpreter from within the community and generally lasted from 35–45 minutes. The ice-breaker question: "What is your favorite meal to prepare at home for your family?" was used to assist participants in feeling comfortable speaking within the group and provided rich information on what, how, and why certain foods were prepared.

Audio tapes were transcribed and translated into English by the same bilingual individual who translated the food knowledge survey. Three independent coders, trained in qualitative data analysis, first conducted a general review of the transcripts. Open coding followed using an initial coding tree comprised of the Health Belief Model constructs and FightBAC!™ concepts. Next, the codes were reduced into major categories. The independent results were pooled together and common themes were identified by intercoder agreement to provide reliability to the analysis (Creswell & Plano Clark, 2011).

Mixed methods data analysis

The qualitative and quantitative data were merged in the analysis and interpretation phases of the study. Using overarching dimensions, focus group themes were compared with food safety knowledge survey to uncover supporting, diverging and other findings for interventions and future research (Creswell & Plano Clark, 2011).

Results

The majority of participants were female and from Mexico. About half of the participants were employed full or part time outside the home. Participants tended to have low education with 45% not having a high school degree and another 19% reporting high school/GED as their highest level of education (Table 1). Most all participants used Spanish for focus group discussions (47 of 52).

Quantitative results

The overall average food safety knowledge score was $56\% \pm 11$ (Table 2). The average score for correct responses in each concept

Table 1

Demographic characteristics of Hispanic main food preparers in families with children 10 years of age or younger participating in food safety research using mixed methods.

	Pilot survey n = 38	Mixed Methods Survey and Focus Groups n = 52	Total n = 90
Gender, n (%)			
Female	35 (92)	51 (98)	86 (96)
Male	3 (8)	1 (2)	4 (4)
Age, years ^a (Mean ± SD)	34.1 ± 7.4	36.7 ± 7.5	35.7 ± 7.6
Education, n(%) ^b			
Less than high school	10 (26)	20 (38)	30 (33)
Some high school	6 (16)	5 (10)	11 (12)
High school/GED	8 (21)	9 (17)	17 (19)
Some college	10 (26)	6 (12)	16 (18)
College grad	1 (3)	5 (10)	6 (7)
Post-college grad	0	2 (4)	2 (2)
Employment n(%) ^c			
Full-time	11 (29)	15 (29)	26 (29)
Part-time	7 (18)	7 (14)	14 (16)
Unemployed	17 (45)	24 (46)	41 (46)
Country of origin, n (%) ^d			
Mexico	26 (68)	36 (69)	62 (69)
Guatemala	2 (5)	4 (8)	6 (7)
El Salvador	2 (5)	3 (6)	5 (6)
Honduras	0	2 (4)	2 (2)
Peru	0	1 (2)	1 (1)
Puerto Rico	0	1 (2)	1 (1)
Costa Rica	0	1 (2)	1 (1)
Columbia	0	1 (2)	1 (1)
United States of America	7 (18)	2 (4)	9 (10)

^a Missing 6 total responses.

^b Missing 8 total responses.

^c Missing 9 total responses.

^d Missing 2 total responses.

in descending order were: Cook (62.5% ± 24), Separate (61.3% ± 21), Chill (60.0% ± 18), groups at increased risk (58.8% ± 16), foods that increase risk (52.3% ± 14), and Clean (49.1% ± 11). The question, “What is the safest way to cool a large pot of soup?” had the lowest correct response (11%) in the entire survey (Chill concept). Printed materials, classes and workshops were top ranked preferences for food safety education. Television, radio, and electronic methods were rated lowest. Cronbach’s alpha for the final survey was $r = 0.659$.

Qualitative results

Several themes with supporting quotes were obtained from focus group discussions (Table 3).

Ethnic dishes popular

When queried about favorite family dishes, many traditional Hispanic foods dishes were preferred and frequently prepared. Enchiladas, soups, stews, and chicken prepared by several methods were leading dishes favored by family members, including children. Food ingredients in these dishes included chicken, rice, beans, vegetables, spices and sauces.

Relating food to illness

Participants had few experiences with foodborne illness, but those who did expressed the misery of the related symptoms and the fear of eating certain foods thereafter. Fear and confusion were largely present in this theme. Frequently the concept of “mixing foods” as a source or contributor to foodborne illness emerged from the discussion and alluded to the cultural belief of hot and cold theory. Confusion existed between how and why foods can make people sick, and how the body reacts to the illness. One participant described the body’s defenses such as “the illness came out her eyes”.

Little distinction between food allergies and foodborne illness existed in the discussions.

Fresh food in home country

Participants emphasized that they had access to and used more fresh ingredients, such as chicken and fresh produce, when preparing meals in their home countries. “In Mexico, everything is fresh” and “The tomatoes, the peppers everything is home grown [in home country].” They perceived that foods used in the United States contained more hormones, preservatives, and chemicals which were undesirable. Despite these beliefs, fewer fresh foods were purchased in the United States due to expense because “Another thing is that everything [in United States] is too expensive, fresh fruits and vegetables are extremely expensive.” In contrast, the packaging and labeling of food in the United States was deemed desirable by participants because these processes made food cleaner than that obtained in their home countries.

Food safety practices

Main food preparers were aware of the need for cleanliness and hygiene for food safety. Keeping foods, hands and counters clean were verbalized as frequent practices as summarized by one participant, “Wash your hands, wash fruits, clean tables, babies high chairs need to be cleaned very well” and by another as “It is more about hygiene.”

A “clean” concept that emerged four times in three different focus groups was the use of chlorine bleach to wash fruits, vegetables, and countertops. Paying attention to expiration dates, “First of all, check the expiration date” was described as a common food safety practice.

Face to face learning

When asked about how they desired food safety education, participants requested oral bilingual communication in a class format as voiced by one participant, “Bring it (food safety education) to us with a teacher”. Frequently, the use of cooking classes was requested. Current sources of food information included oral communication with community members, doctors or other trusted people.

Mixed methods results

Many qualitative themes aligned with quantitative data (Table 4) while some results diverged and food safety implications and messages emerged.

Discussion

Little is known about food safety among Hispanic families in the United States who have children 10 years of younger. This study examined food safety knowledge and beliefs within this population to identify food safety messages that address cultural beliefs and food habits adopted by this group that are passed on from generation to generation. Qualitative and quantitative inquiry identified collaborative and discrepant findings for a more comprehensive approach to food safety education for food preparers for young children in this ethnic group.

Foods frequently prepared

Low food safety knowledge scores existed for common ethnic foods and ingredients frequently prepared at home. Hispanic soups, pozole (hominy) and bean soup, were mentioned in four of six focus groups. The lowest scored food safety knowledge question dwelt with cooling large pots of soup as only 11% knew the correct procedure. Only 27% identified leftover soup that is reheated until warm

Table 2

Food safety knowledge responses of main food preparers (n = 90) in Hispanic families with children 10 years of younger.

Clean	n (%) ^{a,b} Correct responses	Chill	n (%) ^{a,b} Correct responses
1. How should you wash fresh fruits and vegetables to keep you from getting food poisoning? Hold under cool running water	37 (41)	15. Your electricity went off in your freezer and the meat, chicken, and fish thawed and felt warm. What should you do to prevent food poisoning? Throw them away	37 (41)
2. How should dishes be washed to prevent food poisoning? (Check all that apply) Hand wash them and rinse right after the meal and then let them air-dry	45 (50)	16. Your child is going to be eating 2 hours after you cook a meal. How should you keep the meal safe before your child eats it? Store it in the refrigerator and reheat it when the child is ready to eat it	47 (52)
Wash and dry them in a dishwasher	39 (43)	17. Which food needs to be refrigerated to prevent food poisoning? An open can of beans	79 (88)
3. Which is an acceptable way to clean a cutting board or counter after it is used for raw meat? (Check all that apply) Wash with hot soapy water, rinse with water, then rinse with bleach	68 (76)	18. What is the safest way to cool a large pot of hot soup? Put the soup in a clean shallow pan and refrigerate right away	10 (11)
Wash cutting board in a dishwasher	21 (23)	19. How long can you store <u>cooked</u> hamburger and chicken in the refrigerator to eat later? 3–4 days	25 (28)
4. How should kitchen counters be cleaned to prevent food poisoning? Wash with hot soapy water, rinse and wipe with a bleach solution	32 (36)	20. How long can you store <u>raw</u> hamburger and chicken in the refrigerator to eat later? 1–2 days	51 (57)
5. What is the best way to wash your hands? Run water, moisten hands, apply soap, rub hands together for 20 seconds, rinse hands, dry hands	55 (61)	21. It is safe to give an infant a bottle of baby formula that has been out of the refrigerator for longer than 2 hours. False	58 (64)
6. Washing hands after changing a diaper: Decreases the chance of food poisoning	65 (72)	22. Refrigeration eliminates harmful germs in food. False	48 (53)
Separate		23. If a leftover food looks and smells good, it is still safe to eat. False	52 (58)
7. If you have a cut or sore on your hand, what should you do before you prepare food for your family? Put a bandage on the sore and wear a glove	58 (64)	Foods that increase risk	
8. Where is the best place to store raw meat in the refrigerator? Below foods that are ready to eat	25 (28)	24. Eating which of these foods will increase a person's risk of food poisoning? (Check all that apply) Baked potato that was left on the counter overnight	40 (49)
9. Putting raw meat in a separate bag (away from other food items) before placing it in the grocery cart? Decreases the chance of food poisoning	46 (51)	Refried beans cooled on the counter	29 (33)
10. When preparing food, you should wash your hands after touching which of these? (Check all that apply) Dirty pots and pans	73 (81)	Fried eggs with a runny or soft yolk	31 (35)
Fresh fruit	20 (22)	Raw homemade cookie dough or cake batter	24 (28)
Cell phone or home telephone	74 (82)	Sushi	30 (35)
Cook		Raw shellfish	70 (82)
11. What is the best way to tell if hamburgers are cooked enough to prevent food poisoning? Measure the temperature with a food thermometer	38 (42)	Unpasteurized fruit juice	26 (29)
12. What is the best way to tell when chicken has cooked long enough? Test with a meat thermometer	35 (39)	Sliced melon	13 (14)
13. To prevent food poisoning, how long should leftover soup be heated? Until it is boiling hot	76 (84)	Raw sprouts (alfalfa, bean, clover, radish)	20 (24)
14. A food is properly cooked in a microwave oven when (Check all that apply) You follow directions on the package	71 (79)	Leftover soup reheated until warm but not boiling	25 (27)
You test the food with a thermometer	27 (30)	Raw milk (not pasteurized) or fresh cheese made with raw milk	53 (62)
		Infant milk or formula with honey added	28 (33)
		Milk with raw egg added	59 (69)
		Hamburger cooked rare	69 (82)
		25. <i>E. coli</i> (a harmful germ) in undercooked hamburger can cause kidney failure in children. True	55 (61)
		26. Undercooked chicken and raw eggs can carry <i>Salmonella</i> (a harmful germ). True	79 (88)
		27. It is safe to use raw eggs in recipes that will not be cooked. False	62 (69)
		Groups at increased risk	
		28. Which foods will likely cause food poisoning for pregnant women, infants, and children? (Check all that apply) Cottage cheeses	64 (71)
		Cold deli salads	12 (13)
		Hot dogs that have not been heated	46 (51)
		Raw eggs	63 (70)
		Undercooked eggs	60 (67)
		29. Which of these people will likely get sick from harmful germs in food? (Check all that apply) Preschool children	68 (76)
		Pregnant women	59 (66)
		Older people (age 60 and over)	64 (71)
		People with type 2 diabetes	29 (32)

^a All questions have missing responses.^b Average Food Safety Knowledge Score = 56% ± 11. Average Score for correct responses by Concept/Category: Clean = 49% ± 11, Separate = 61.3% ± 21, Cook = 62.5% ± 24, Chill = 60.0% ± 18, Foods that increase risk = 52.3% ± 14, Groups at increased risk = 58.8% ± 16.

Table 3

Themes and supporting quotes describing food safety among focus groups of Hispanic main food preparers (n = 52) in families with children 10 years and younger.

Theme	Quotes
Ethnic dishes popular	<p>"Chicken enchiladas with cream and cheese."</p> <p>"I prepare chicken a lot with rice and bread."</p> <p>"Grilled chicken with vegetables and hot sauce."</p> <p>"Chicken salad, cold chicken salad, rice and mole sauce."</p> <p>"Enchiladas, pozole." (Mexican soup)</p> <p>"We make barbacoa, mizote (pit barbeque meat), or pozole."</p> <p>"Chicken, beans, and on the weekends it is chilaquiles." (fried tortilla chips/sauce)</p> <p>"I like fish soup."</p> <p>"Pozole."</p>
Relating food to illness ^a	<p>"I think it is more of an allergy than food poisoning."</p> <p>"Well, that [food poisoning] happens because sometimes food is mixed and they are not supposed to be mixed and there is when it begins."</p> <p>"I think that by eating the food cold." [is why I got sick from food]</p> <p>"It might have a little dirt and this will create antibodies to defend the bacteria and you will not get sick."</p>
Fresh food in home country	<p>"In my city... they are selling meat; the cow was butchered the day before. Everything is fresh. Eggs were laid by the hen that same day or pretty close. If we eat chicken, the chicken is killed at that same time."</p> <p>"More things are added to the meat [in America] so that it can last longer. It is fresher in my home country."</p> <p>"Over there [home country] you kill the chicken and it is cooked immediately."</p>
Food safety practices	<p>"Keep everything clean."</p> <p>"Put them in a bowl of water and two drops of chlorine. I leave it there for ten minutes and then I prepare them." [things that are not cooked]</p> <p>"It is difficult to maintain safe food. ...my family has not gotten sick, I think I do things correctly."</p> <p>"It is safer when one prepares foods at home than eating at a restaurant."</p>
Face to face learning	<p>We want a class like this one."</p> <p>"Programs like this one." [in-person]</p>

^a Based upon analysis of the transcripts and intercoder agreement, we discerned that hot and cold "types" of foods were the topic and not food temperature.

but not boiling as a food that increases foodborne illness risk. These findings suggest that leftover soup has the potential as a food carrier for foodborne illness in this population. Safe use of other leftover foods is an area of concern. For example, the use of legumes were described; "the beans are cooked so that they last at least two days". It is unclear how the beans are cooled and refried over the course of a few days as one third of participants correctly identified that eating refried beans that are cooled on the counter as increasing the risk of food poisoning. Low food safety knowledge and gaps in how to handle leftovers safely were also found among Caucasian main food preparers for young children in the Midwest (Meysenburg et al., 2014) and United States (Lum, Albrecht, Yaseen, Litchfield, & Ritter-Gooder, 2013).

Chicken was mentioned more frequently than any other food item used in meal preparation in the home. Similar to another study, food safety knowledge was low for storing raw and cooked chicken and cooking chicken safely (Redmond & Griffith, 2003). Inadequate knowledge of safely chilling meat/poultry prior to consumption could be due to purchase of freshly slaughtered animals at open markets in the home country immediately prior to meal preparation. Storing uncooked chicken safely may be a new food handling practice as "you kill the chicken and it is cooked immediately (in my home country)". One food preparer referred to chicken as "one of the most delicate foods because it is easier to become spoiled" and another expressed fear "I am frightened with the chicken... when I am cooking chicken, I do not let my children come into the kitchen".

Compared to other populations, the knowledge or practice of using a thermometer to check internal temperatures of cooked meats is low. Thirty-nine percent of main food preparers in this study knew that using a thermometer is the best way to tell when chicken has cooked long enough. When other main food preparers for young children were studied, 57% residing in Midwestern states (Meysenburg et al., 2014) and 53% within the United States (Lum et al., 2013) reported always following this practice. Among other consumers, the use of a food thermometer was the least frequent food safety practice (U.S. Department of Health and Human Services, 2011). The frequent preparation of chicken combined with low food safety knowledge poses high risk for contracting *Salmonella* foodborne illness in this population. Food safety messaging using cultural foods within the Chill and Cook FightBAC!™ concepts are indicated based upon these findings.

Fresh versus packaged food ingredients

Divergent findings surrounding fresh and packaged foods were discovered in two aspects related to safety, "chemicals/preservatives" and "cleanliness". Main food preparers identified a predominate difference in the food supply between the United States and their home country. Fresh products (chicken, and meat) purchased in open markets in the country of origin were deemed safer than packaged foods, as "hormones are not injected into them because over there the food is natural" and "They [Americans] add a lot of preservative so that the meat can last longer". However, packaged foods available in the United States were perceived as cleaner due to processing. Another study found that Hispanics perceive food in the United States as being cleaner due to the labeling packing system (Koro, Anandan, & Quinlan, 2010; McArthur, Viramontez Anguiano, & Nocetti, 2001).

Participants were aware that fresh fruits and vegetables have recently made people sick in the United States but had low scores (41%) on correctly washing fresh fruits and vegetables to prevent foodborne illness. Sliced melon was identified by a low percentage (14%) as a food that increases risk. However, due to cost, fresh produce may be used less often than canned and frozen produce in this population. Fewer fresh fruits and vegetables are used in meal preparation by Hispanic migrant workers in the United States due to their perceived low quality and high cost (Cason, Nieto-Montenegro, & Chavez-Martinez, 2006). A finding that significantly higher microbial loads were detected on produce in low versus high social economic grocery stores (Koro et al., 2010) may also impact food safety in this population, depending upon items purchased. When fresh produce is used, these Hispanic/Latino families may be at a higher risk for foodborne illness due to low food safety knowledge.

Sixty-two percent of main food preparers identified raw unpasteurized milk or fresh cheese made with raw milk as high risk foods. This is a positive finding as Hispanic populations in localized areas of the United States have been affected with Listeriosis foodborne illness and mortality in the United States due to consumption of unpasteurized milk products (Lay, Varma, & Marcus, 2002; Linnan et al., 1988; MacDonald et al., 2005; Voetsch et al., 2007). Food safety knowledge in this area may surpass other populations as other researchers reported that only one third of Americans had heard of *Listeria* as a common foodborne pathogen in the United States (Lin, Jensen, & Yen, 2004). Another high risk practice, adding honey to infant formula, was identified by 33% of main food preparers. Continued messages on why these foods and practices are high risk among this population are recommended.

Food handling

High self-efficacy was verbalized in the ability to prepare food safely at home. When a family member contacted foodborne illness "it is not because they got sick from my food". Main food preparers

Table 4

Mixed method analysis of food safety data obtained from main food preparers in Hispanic families with children 10 years or younger.

Dimension	Qualitative findings (n = 52)	Quantitative findings (n = 90)	Mixed method interpretation
Foods frequently prepared	Chicken is common ingredient in ethnic dishes. “I use chicken on a regular basis, on mole, birria, fried chicken and also chicken in different ways.” Pozole, fish and bean soup among favorite meals. “My children love the black bean soup.”	Correct food knowledge scores for handling chicken and soup safely: <ul style="list-style-type: none"> • Best place to store raw meat in refrigerator (28%) • Meat thermometer is best method to check chicken for doneness (39%) • Undercooked chicken can carry <i>Salmonella</i> (88%) • Length of time for storing raw chicken in refrigerator (57%) • Safest method to cool large pot of hot soup (11%) • Heat leftover soup to boiling hot (84%) • Leftover soup reheated until warm but not boiling increases food poisoning risk (27%) • Discard thawed meats/fish if they feel warm after electricity goes out in freezer (41%) 	Inconsistent and low knowledge on safe food handling of frequently prepared foods (chicken and soups) put young children at increased risk of foodborne illness. Food safety messages within the FightBAC!™ Cook and Chill concept for these common ethnic food ingredients/items are indicated.
Fresh versus packaged	“Lately in vegetables and fruits (foods causing foodborne illness outbreaks)” and “unwashed fruits” responses in identification of foods that increase risk. Fresh fruits and vegetables are more expensive in the United States than home country influencing participants to buy more canned and frozen products.	Correct food safety knowledge scores for fruits and vegetables: <ul style="list-style-type: none"> • Procedure for washing produce (41%) • Washing hands after handling fresh fruit (22%) • Sliced melon is a food that will increase the risk of food poisoning (14%) 	Despite frequent use of fresh fruits and vegetables in meal preparation in home country and knowledge of recent outbreaks within the United States, food safety knowledge for handling these foods is low. However, the current reported use of fresh produce is limited in the United States which may reduce risk from these foods.
Food handling control	High self-efficacy in preparing food safely for the family, low confidence in restaurant food. “It is safer when one prepares foods at home than eating out at a restaurant.” Misunderstanding of mechanism of foodborne illness. “Mixing something that has been cooked with something that has not been cooked. And this causes the bacteria.”	Low food safety knowledge scores overall (Mean = 56% SD ± 11).	High self efficacy in ability to prevent foodborne illness coupled with low food safety knowledge scores implies over-confidence in areas not fully understood. Further exploration of the impact of cultural belief of hot/cold theory on food safety is indicated.
Interactive learning style	Classes, workshops, and print material in Spanish language for food safety education preferred. “We want a class like this one (focus group).”	<ul style="list-style-type: none"> • Print material, classes, and personal contact with educators were highest ranked sources for education. • Television, radio, email and texting were lowest ranked preferred methods. 	Both data sets are congruent and indicate that classes and materials in Spanish are desired for food safety education.

had low confidence in safety of food prepared outside their home; “it (food) is a lot safer at home” and “if you cook more at home and eat out less, there is less risk”. This is a common finding among other populations (Byrd-Bredbenner, Maurer, Wheatley, Cottone, & Clancy, 2007; Byrd-Bredbenner et al., 2007; Redmond & Griffith, 2003, 2004a, 2004b), including main food preparers for children (Meysenburg et al., 2014). Only one main food preparer was unsure; “maybe I think I am doing something right, but maybe I am not”. A recent study among Mexican-Americans living in the United States found that those born in Mexico were less aware of food safety risks (Parra, Kim, Shapiro, Gravani, & Bradley, 2014). Over two thirds of our participants reported Mexico as their country of origin.

A misunderstanding of how foodborne illness is contracted was present and could be attributed to a traditional Hispanic belief known as the hot and cold theory (Batty & Kurko, 2005). Unrelated to food temperature, specific foods are perceived to be either “hot” or “cold” for use in treatment. Improper use or mixing of “hot” and “cold” foods together could result in foodborne illness as “the food poisoning happens because sometimes food is mixed and they are not supposed to be mixed and there is where it begins”. Moreover, “sometimes they (child) do not want to eat that food again. They develop a fear for that specific food”. An emphasis on the bacterial source of foodborne illness and safe food handling may address cultural beliefs that contribute to confusion and misunderstanding.

Hispanic immigrant families were aware of the need for cleanliness and hygiene to keep food safe. This may be due to public health education targeting these specific behaviors. The practice of adding “a drop of chlorine in a kitchen vessel full of water” for washing

foods and countertops is effective and safe if used correctly. This practice could also be carried over from the home country where chlorine bleach is used for unsafe water.

Interactive learning style

Both data sets corroborated in describing preferred methods for receiving food safety messages and mirror other findings that suggest cultural sensitive training (Palmeri, Auld, Taylor, Kendall, & Anderson, 1998). Oral communication, in Spanish, using face to face learning is preferred for food safety education.

Traditionally, Hispanics place decision-making authority in their elders so the use of abuelas, Hispanic grandmothers, may be utilized in food safety messaging. Abuelas who received training were effective as nutrition educators in a Hispanic community in Colorado (Taylor, Serrano, Anderson, & Kendall, 2000). Food safety messages and education utilizing the FightBAC!™ concepts have shown success in this population. After an urban Latino population in Connecticut was exposed to the critical consumer messages using FightBAC!™ concepts in a campaign, they had a higher level of knowledge compared to those not exposed. Additionally the FightBAC!™ logo was four times more likely to be recognized after the campaign (Dharod et al., 2004).

The key divergent findings of this study have implications for future food safety education. A high self-efficacy in ability to prevent foodborne illness, especially during home preparation of foods was present, coupled with low food safety knowledge scores. Future research should explore effective interventions that address perceived high self-efficacy using oral communication in Spanish. Further study

of the effects of cultural beliefs on food safety practices and knowledge is recommended to inform education messages targeted to this population.

Limitations

Non-random and limited sampling precludes the generalization of the study findings to Hispanics residing in other areas of the United States. The administration of the food knowledge survey prior to focus group interviews may have influenced group discussion. Including Hispanics from several sites across the state was a strength of the study. Involving individuals of Hispanic origin as bilingual translators and interpreters from within the Hispanic community was another strength. The use of mixed method methodology provided insight not achievable with qualitative or quantitative inquiry alone.

Summary

Our research demonstrated that food safety knowledge was low among Hispanic main food preparers for young children. The overall average food safety knowledge score was 56%. Themes that emerged from the focus group discussion on food safety were: Ethnic dishes popular, Relating food to illness, Fresh food in home country, Food safety practices, and Face to face learning. On-site classes and materials available in Spanish were preferred for food safety education. Mixed method analysis revealed high self confidence in preparing food safely with low safe food handling knowledge. Culture specific food safety education with an emphasis on low food safety knowledge throughout all FightBAC!™ concepts and common ethnic foods is needed to lower the risk of foodborne illness especially among Hispanic families with young children.

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